USACE
Hurricane and Storm Damage Reduction

Shoreline Change Initiative

March 31, 2008

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Significance of Coastal Areas

-More than one half of the U.S. population live near our sea and lake shores, doubling from 1960 to 2000, Estimated 3600 new residents daily

-Estimated 19 million homes in the last three decades – 1500 a day

-An estimated 75% of U.S. vacations being spent at the beach

-Tourism industry is largest employer and fastest growing economic sector

-2 million jobs

-$6 trillion generated by coastal watersheds in 2003 – more than half nations economy

This comparison of beach erosion and renourishment at Miami Beach shows the constant need for fresh sand in Florida. (Photo courtesy of Jacksonville District)

Environment

Clean oceans and wide beaches are crucial elements of our environment. Beaches sustain animals, fish, sea turtles, birds, plants, and other wildlife including many rare, threatened, and endangered species.

Solutions

The Corps of Engineers always looks for the most economical, environmentally sound and socially acceptable solutions to shore protection. In some cases, this will involve hard structures - jetties, seawalls, breakwaters, etc.

Hard Structures

The seawall in Galveston, Texas, is an excellent example - it has kept the city safe from a repeat of the destruction it experienced in September 1900. In San Francisco, a seawall put in place over 60 years ago has protected Golden Gate Park from severe winter storms. In neither case has the seawall caused any subsequent erosion.

Beach Nourishment

In many other cases, a preferable approach is beach nourishment, the placement of sand along the beach. Beach nourishment can be an economical solution to a storm damage problem.

Beach Nourishment Basics

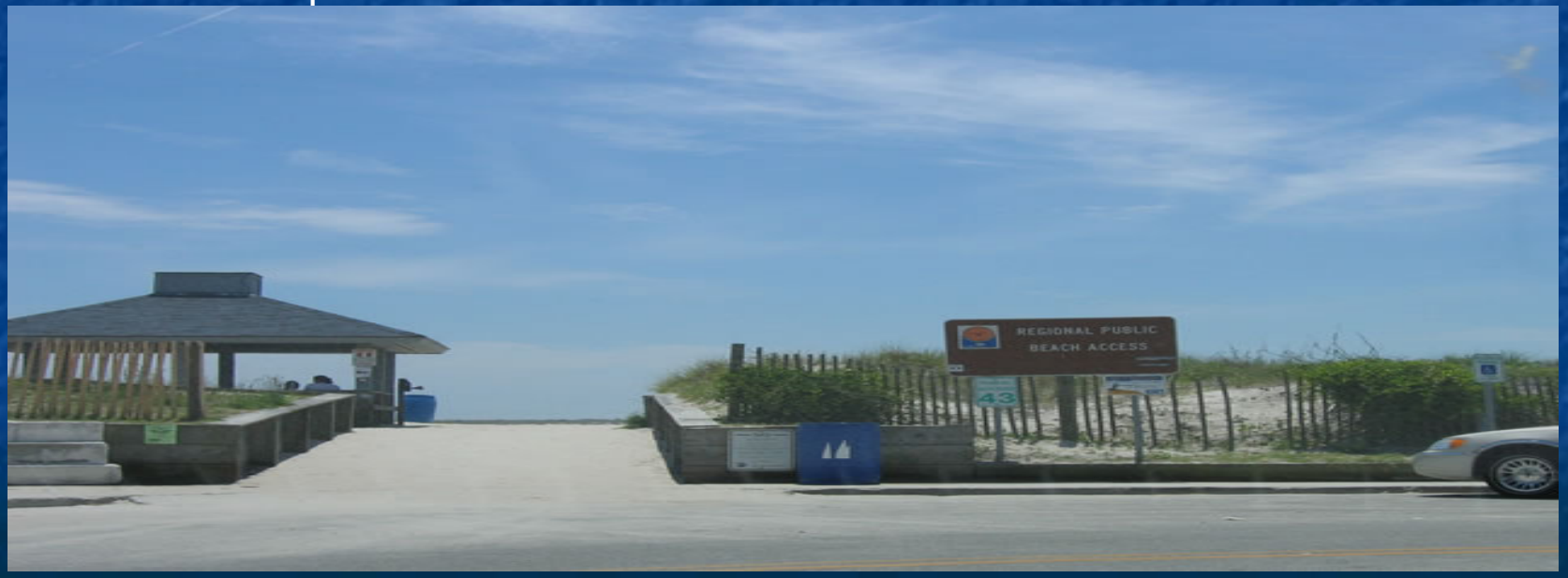
- **Policy and Economics**
  - **Each project specifically authorized by Congress**
  - **Justified by reduction/prevention of storm damage**
  - **Greater than 1:1 B/C ratio (3:1 for budget priority)**
  - **Public access every ½ mile**
  - **Thoroughly evaluated (technical, economics, & environmental) before construction is authorized by Congress (50/50 cost share)**
  - **Construction cost shared 65/35 (typically)**

Optimize

Project design optimizes storm damage reduction benefits relative to costs.

Designing a project to protect against any and all storms is not economically feasible.

Projects are constructed only where public access to the beach is assured and adequate parking is provided, and only after thorough studies have determined a positive benefit to cost ratio exists



General Investigation Study Process

Two-Phase Study Process

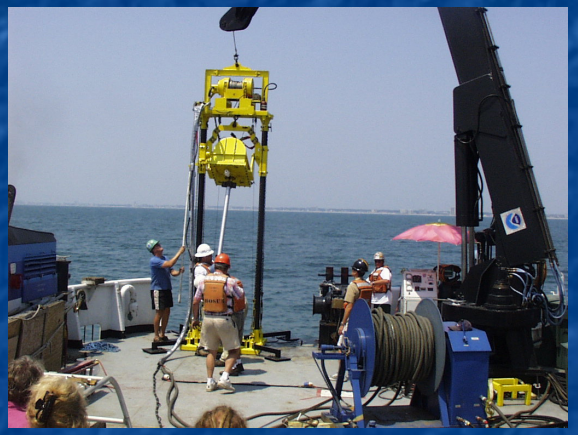
- Federal government conducts a Reconnaissance Study to determine whether a federal project can solve local and regional problems.
- The Reconnaissance Phase is 100 percent federally funded ($100,000 and Congress has to direct us).
- Based upon the Reconnaissance Study , the Federal government and the non-federal sponsor jointly decide whether a full Feasibility study is warranted and sign cost-sharing agreement.

Reconnaissance Phase

- Definition of problems and opportunities; identification and potential solutions.
- Estimation of benefits and costs of solutions to determine prospects for an implemental project. Appraisal of federal interest in potential solutions.
- Determination as to whether or not future studies are appropriate.
- Estimation of feasibility phase costs.
- Corps and non-federal sponsor must agree to share equally in the cost of the feasibility phase (sponsor can do work-in kind).

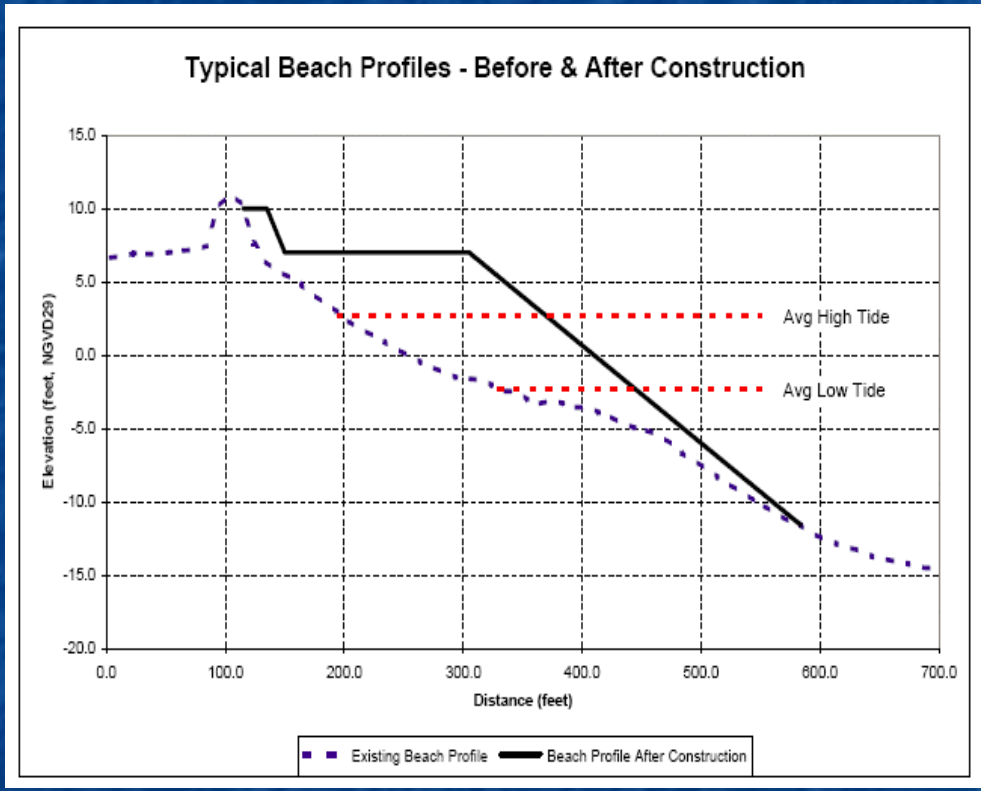
Feasibility Phase

- Further planning and evaluation of alternative solutions.
- Detailed estimation of benefits and costs of alternatives to determine a selected plan.
- Data Collection, Field Studies, Coastal Process Analyses, Damage Assessments, Environmental Impacts, Template Design

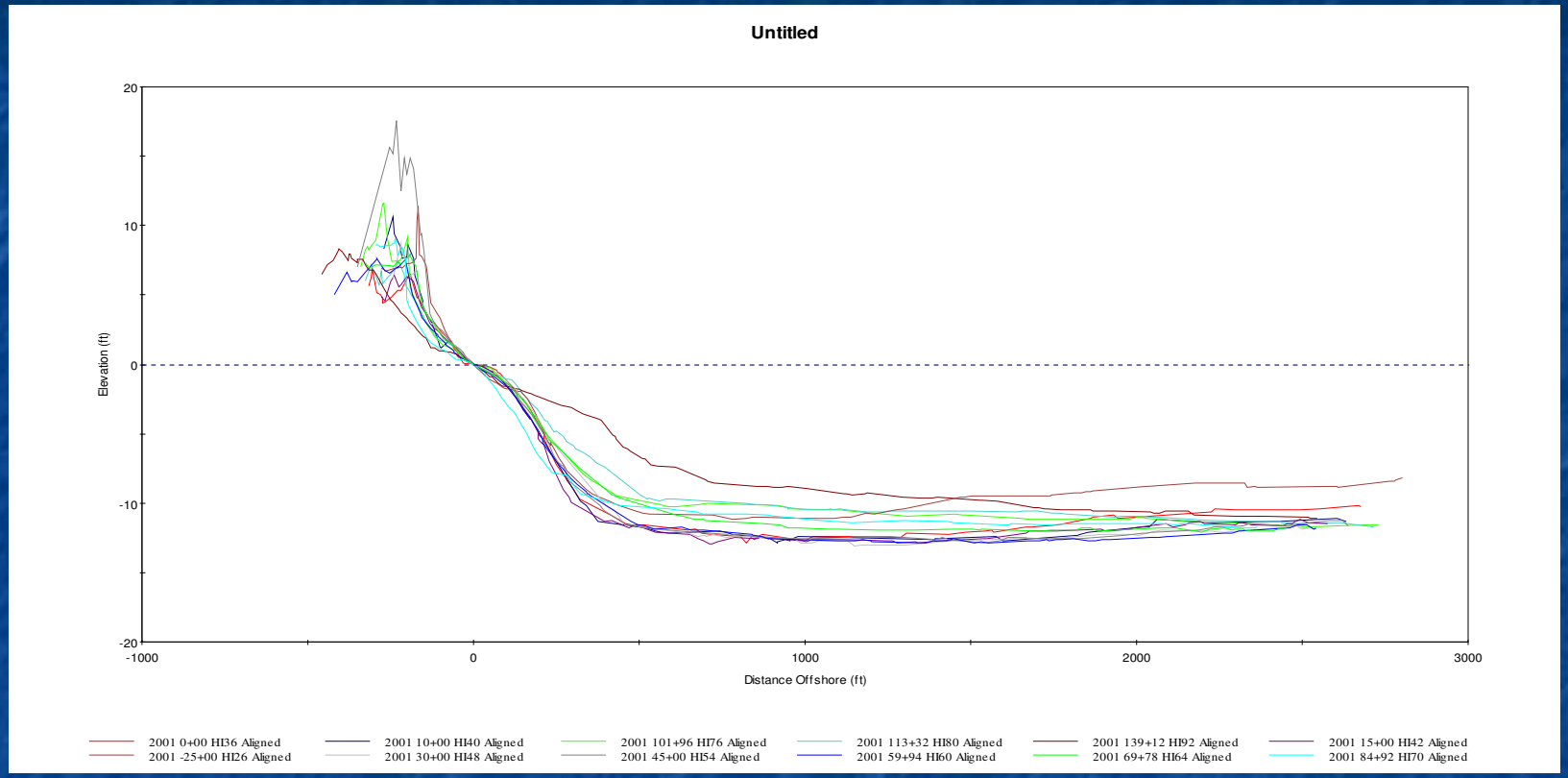


Beach Nourishment Basics

- Protective dune and berm fronted by a sacrificial berm
- Dune height based on maximizing the level of protection (usually a 25 or 50 year storm event)
- Width of sacrificial berm determined by erosion rate and renourishment cycle
- Renourishment cycle based on computer models (life cycle analysis using historical erosion rates and storm frequencies)
- Borrow source must be compatible with native beach
  - <10% fines
  - <35% carbonate
  - Median diameter ≡ surf zone sand



Beach Profiles/Topography



By understanding beach topography above and below the water, coastal engineers can identify coastal processes at the site, calculate the volume of beach fill needed, and determine how long the project is expected to last before renourishment is required.

Borrow Site Investigation

FACTORS:

-Compatibility of sand

-cost

-removal and transportation

-environmental factors

- 3mile limit

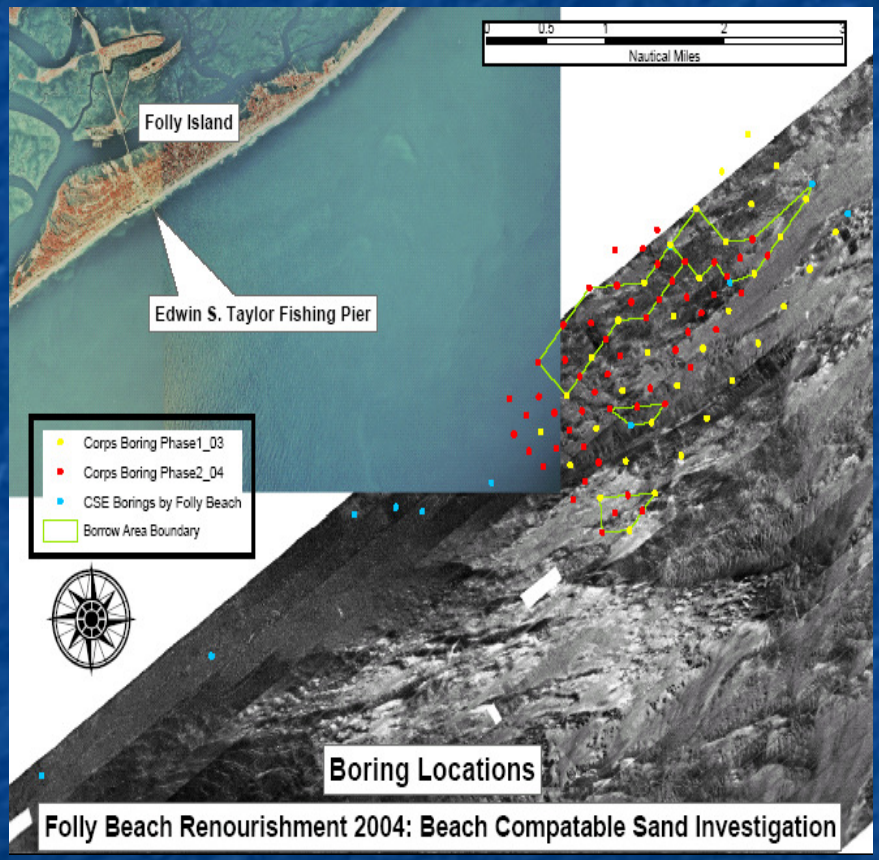
MMS lease

INVESTIGATIONS:

-side scan sonar and sub-bottom profiling

-Live bottom identification

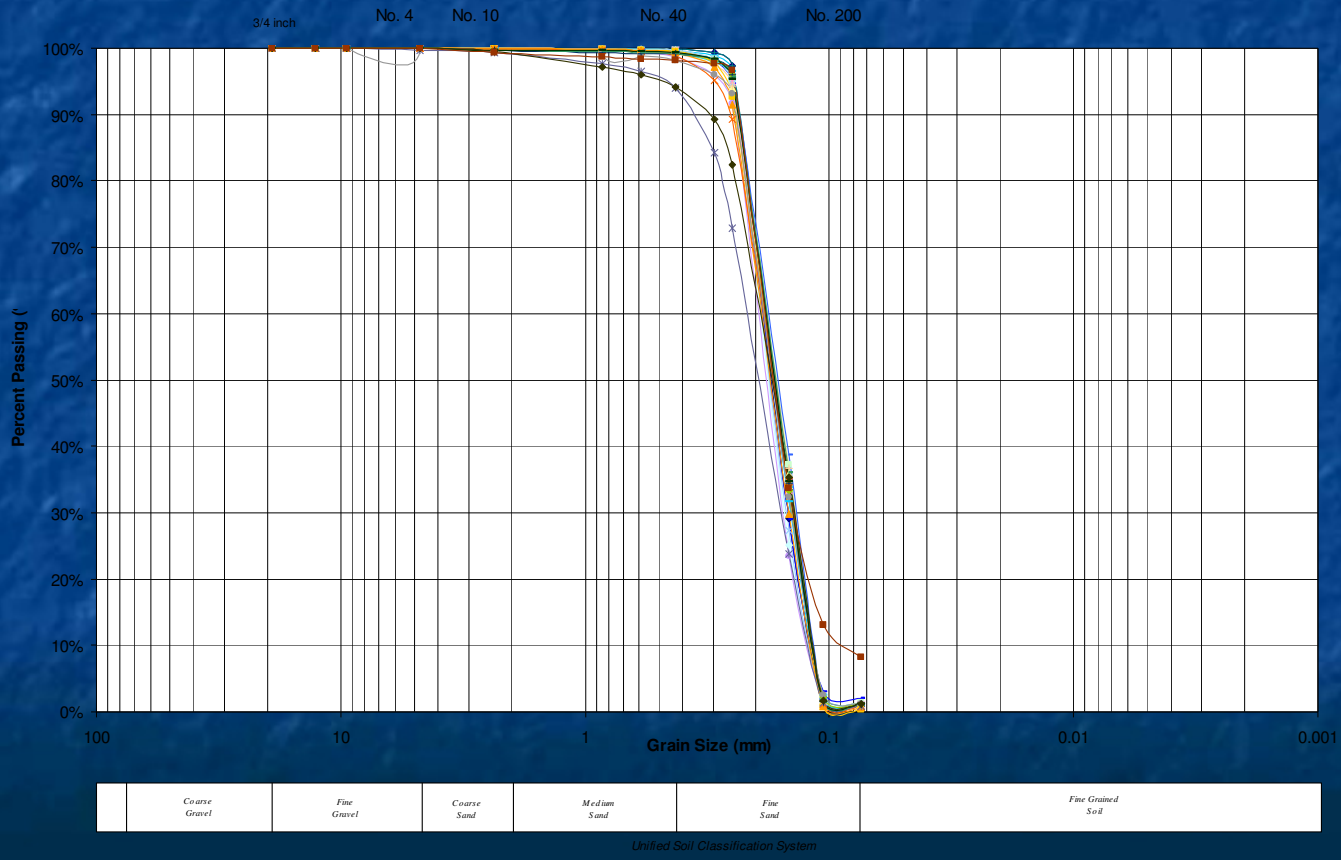
-Vibracores at potential sites



Grain Size Analysis

- Grain size, color, composition, and texture of the material should match the native sand as closely as practical to ensure proper project performance.

Figure B-5 Fripp Inlet Offshore Borrow Area

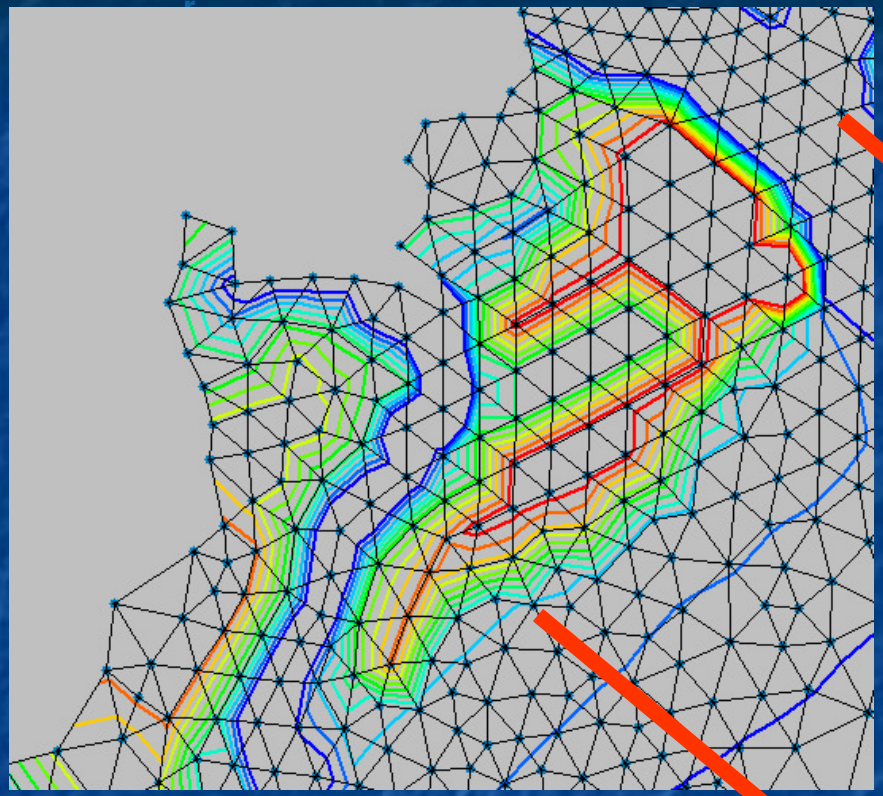


Beach Analysis and Design

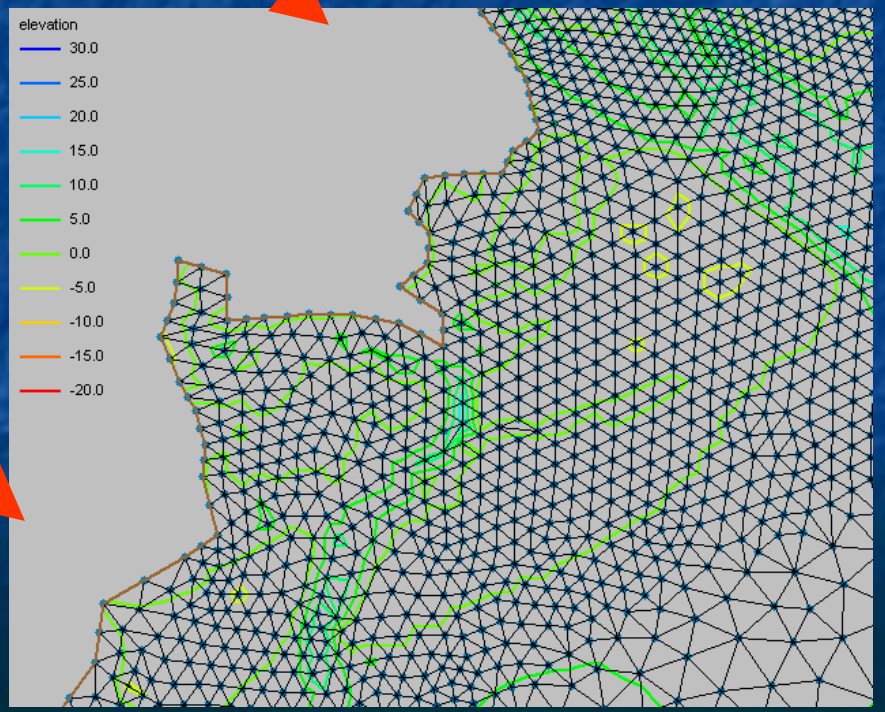
- Every beach nourishment design is unique, since different beaches in different areas have different physical, geologic, environmental, and economic characteristics and different levels of protection justified.

- Because it's impossible to predict with certainty what wave or storm conditions will be in a given year, coastal engineers use **computer models** to help design beach nourishment projects based on a range of **expected beach behavior** and **certain types of storms**.

ADCIRC Model



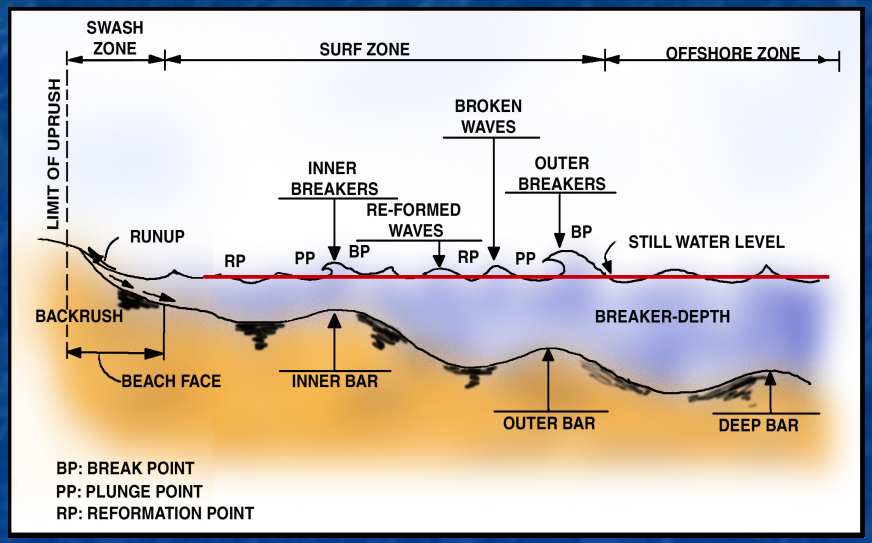
Revised Mesh

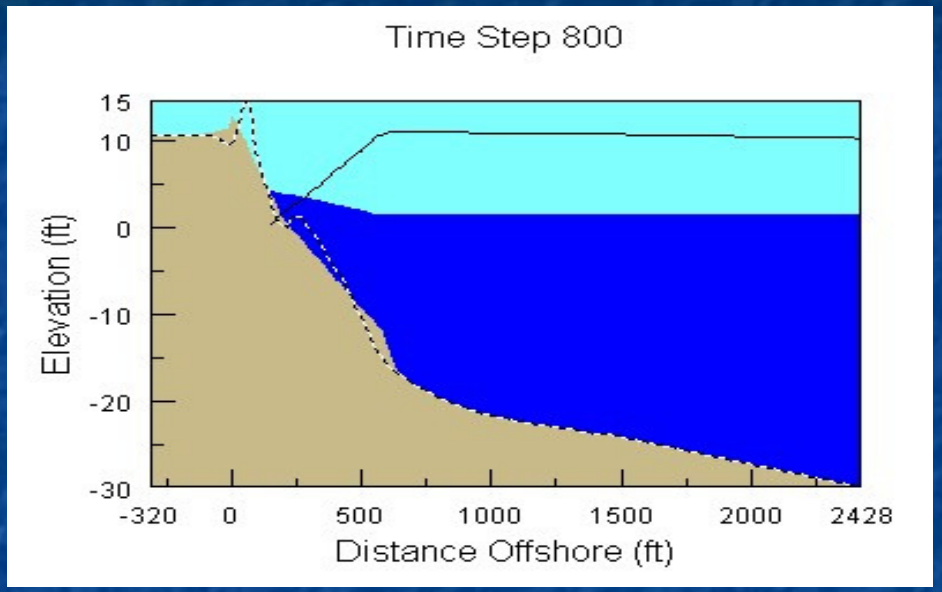


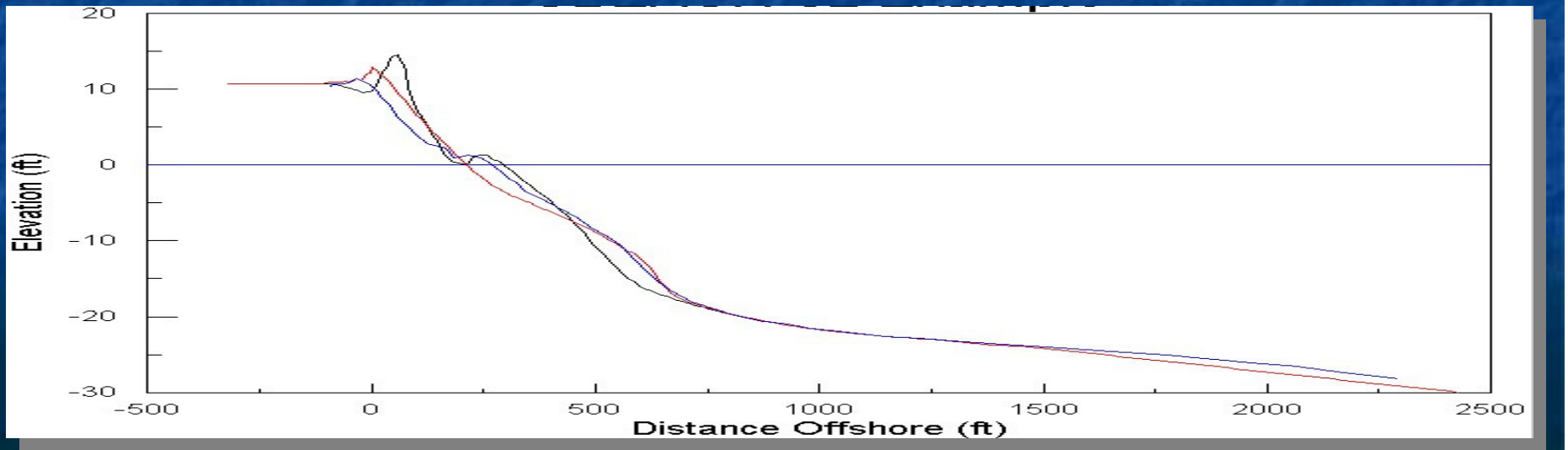
Using Bathymetry/Topography **ADCIRC** can provide tide and storm surge elevations and velocities

SBEACH Storm-induced BEAch CHange Model

Simulates cross-shore beach, berm, and dune erosion produced by storm waves and water levels. Used to evaluate alternatives.



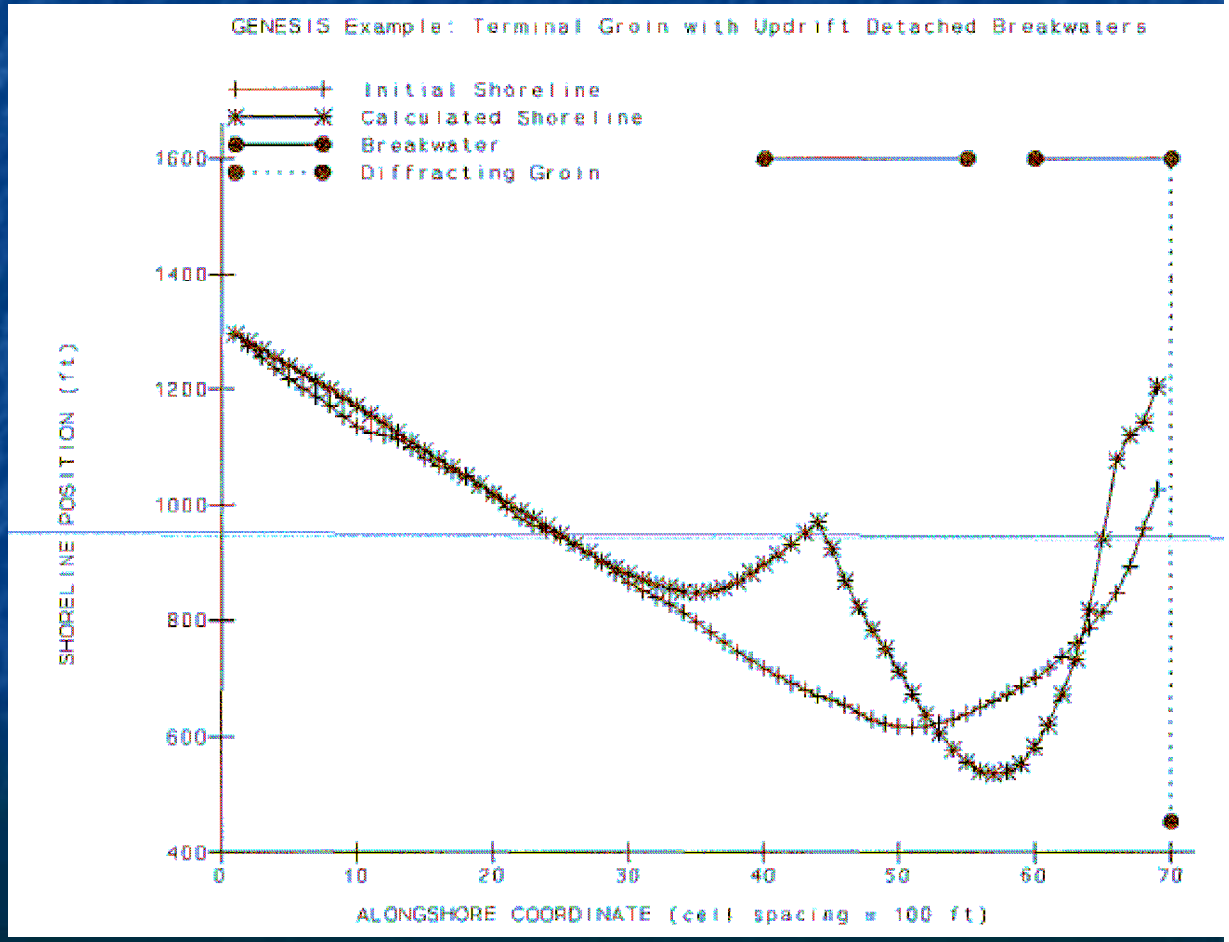




GENESIS – GENEralized model for SImulating Shoreline Change

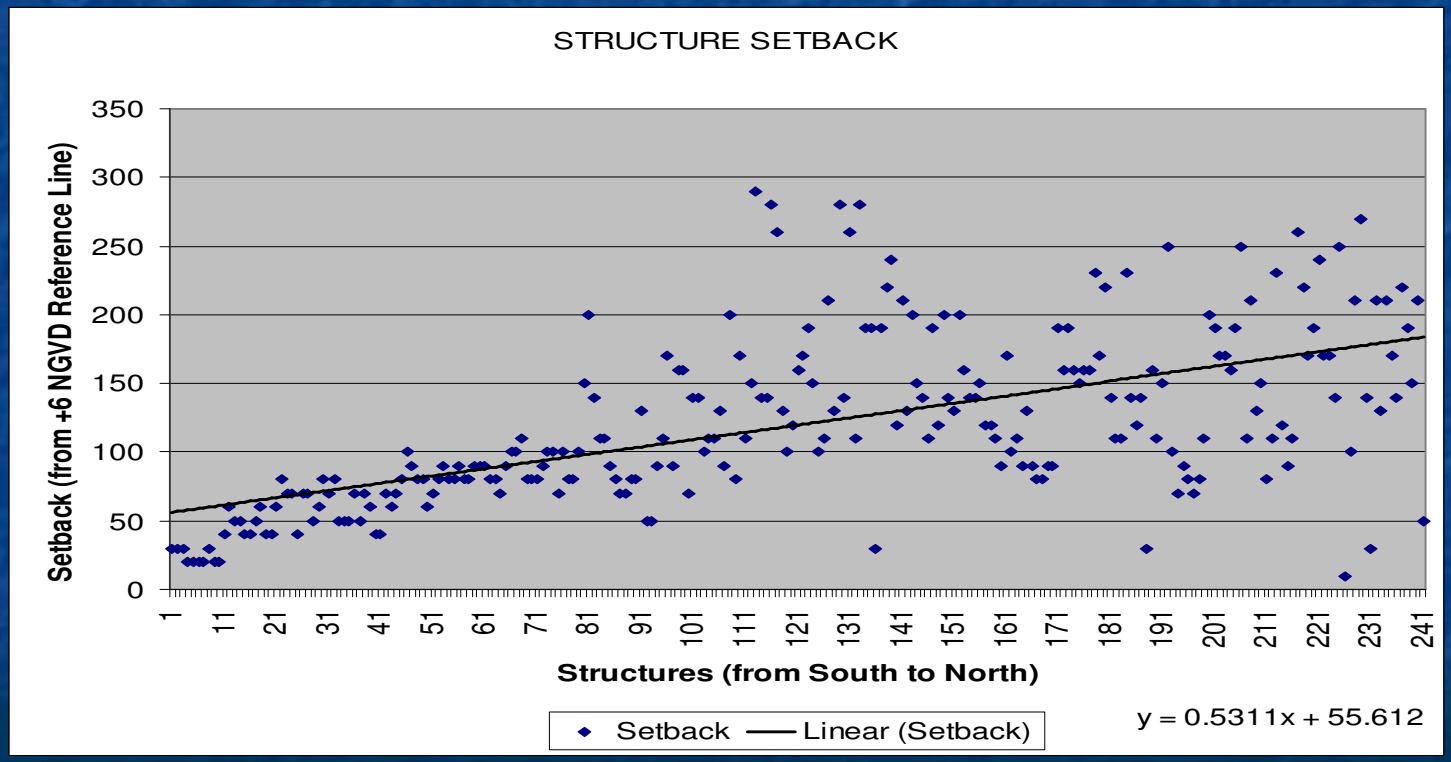
Used for calculating shoreline change due to differences in longshore sediment transport due to breaking waves.

Useful for predicting long-term trends of beach plan shape when provided with an initial beach condition, position and length of present or proposed structures, and wave information. The initial beach condition can be either the without-project condition or the proposed nourished beach.

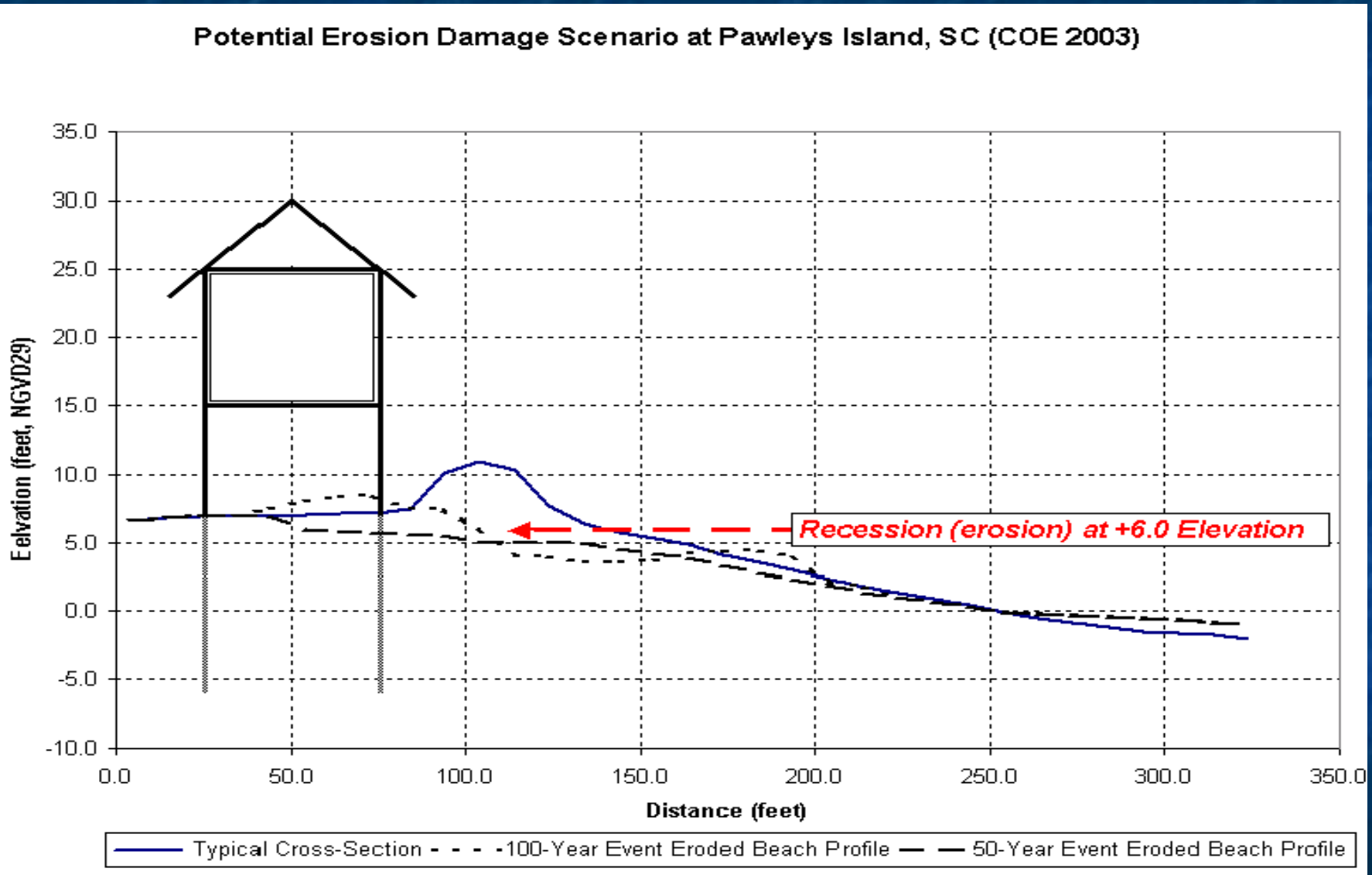


Structure Setback

Inventory of structures, locations, first floor elevations

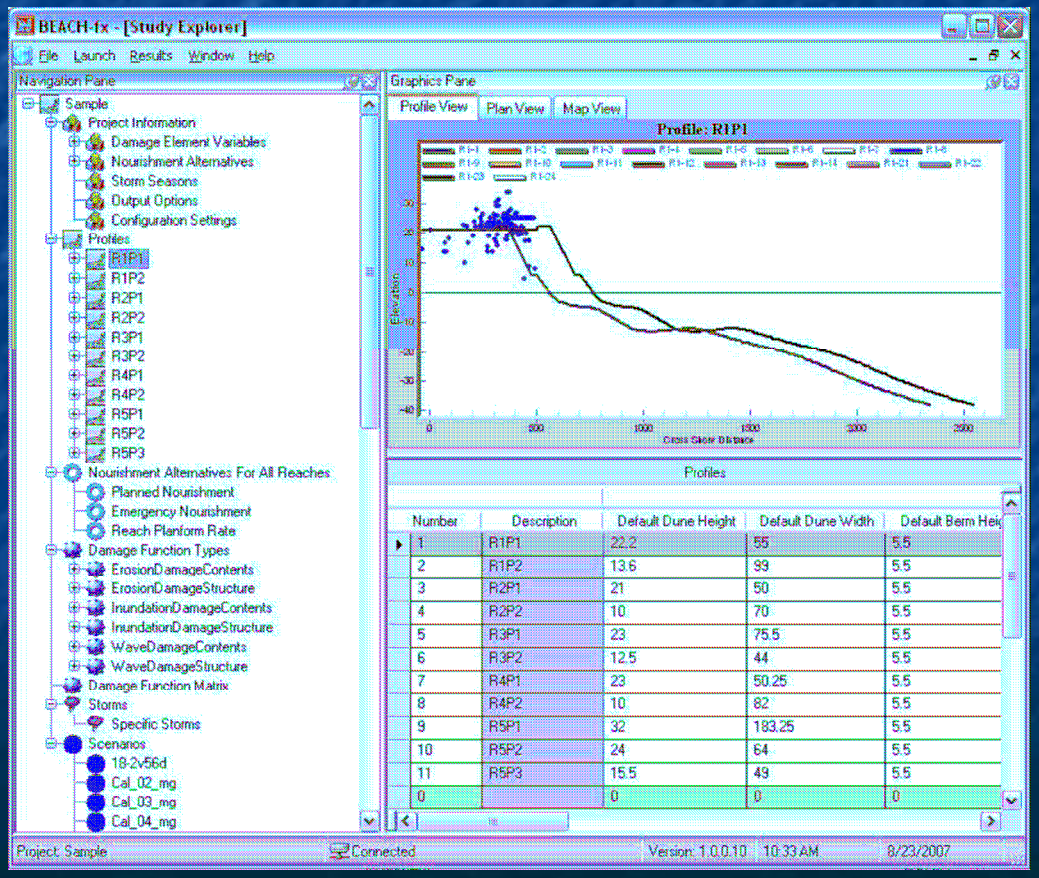


Erosion Damage



Beach-*fx*

Beach-*fx* is an engineering-economic planning tool designed to aid in evaluating and analyzing the benefits and costs of hurricane protection and storm damage reduction projects.



Economic Analysis

- Structure Inventory
- Damage Assessment
- Benefits - Damage Prevention of Alternatives

Average Dune Width (ft)	Average Dune Crest Elevation (ft, NGVD)	Return Period	Average Computed Recession of 6.0' NGVD [Duneface] (ft)	Structure Damage	Content Damage	Pad Damage	Deck Damage	Walkover Damage	Fill Material Damage	TOTAL Damage
45.0	11.3	2Yr	34.68	$561,816	$132,794	$6,407	$39,166	$44,955	$35,418	$820,554
Average Dune Volume (cyds/ft)	Average Structure Setback (ft)	5Yr	46.54	$1,235,152	$370,221	$14,234	$68,760	$73,780	$62,656	$1,824,803
		10Yr	52.96	$1,860,335	$623,462	$22,075	$94,415	$91,164	$82,638	$2,774,089
		25Yr	65.58	$3,947,166	$1,550,327	$51,349	$153,356	$121,340	$133,052	$5,956,589
		50Yr	72.99	$6,003,382	$2,556,238	$81,674	$182,847	$133,235	$172,954	$9,130,331
		100Yr	80.10	$8,180,340	$3,656,999	$113,810	$205,249	$142,501	$213,605	$12,512,504
4.0	71.4	500Yr	97.02	$12,141,359	$5,702,693	$173,653	$229,780	$154,478	$301,993	$18,703,955

Central Reach - Pawleys Island, SC

Average Dune Width (ft)	Average Dune Crest Elevation (ft, NGVD)	Return Period	Average Computed Recession of 6.0' NGVD [Duneface] (ft)	Structure Damage	Content Damage	Pad Damage	Deck Damage	Walkover Damage	Fill Material Damage	TOTAL Damage
194.0	14.6	2Yr	15.12	$0	$0	$0	$0	$3,292	$359	$3,652
Average Dune Volume (cyds/ft)	Average Structure Setback (ft)	5Yr	16.26	$0	$0	$0	$0	$3,814	$427	$4,240
		10Yr	17.69	$0	$0	$0	$0	$4,541	$524	$5,065
		25Yr	21.33	$15	$0	$0	$0	$7,782	$940	$8,737
		50Yr	23.93	$76	$0	$0	$0	$12,713	$1,637	$14,427
		100Yr	27.10	$9,002	$1,204	$71	$71	$20,899	$3,533	$34,781
27.3	148.1	500Yr	35.21	$76,013	$11,526	$609	$585	$52,250	$13,513	$154,497

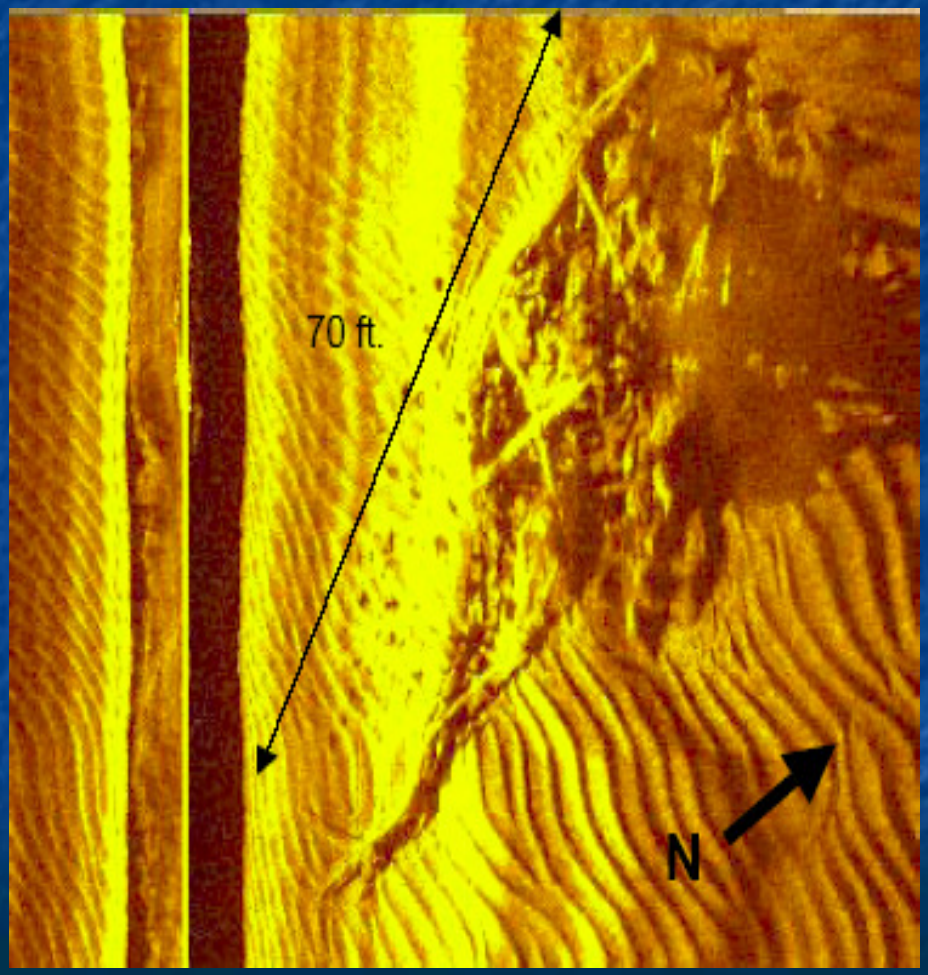
Northern Reach - Pawleys Island, SC

Average Dune Width (ft)	Average Dune Crest Elevation (ft, NGVD)	Return Period	Average Computed Recession of 6.0' NGVD [Duneface] (ft)	Structure Damage	Content Damage	Pad Damage	Deck Damage	Walkover Damage	Fill Material Damage	TOTAL Damage
278.0	13.0	2Yr	11.94	$16,529	$0	$0	$52	$1,738	$1,951	$20,271
Average Dune Volume (cyds/ft)	Average Structure Setback (ft)	5Yr	13.20	$16,578	$0	$0	$63	$1,965	$2,289	$20,895
		10Yr	13.66	$16,806	$0	$0	$71	$2,035	$2,430	$21,342
		25Yr	13.70	$16,732	$0	$0	$71	$2,045	$2,439	$21,286
		50Yr	14.16	$17,644	$0	$0	$93	$2,138	$2,732	$22,607
		100Yr	14.63	$18,124	$0	$0	$121	$2,209	$2,948	$23,401
24.0	151.0	500Yr	17.20	$23,393	$64	$0	$325	$2,662	$4,358	$30,803

Environmental Effects/Issues

- Coastal Barrier Resources Act (CBRA): restrictions on borrow sites
- Evaluation of general biological effects
- Sea turtle nesting effects
- Benthic organism effects: borrow site & surf zone
- Burrowing macro-invertebrate effects
- Essential Fish Habitat
- Endangered Species
- National Environmental Policy Act: (Environmental Assessment / Environmental Impact Statement)
- Shore bird effects (nesting, foraging, & loafing)

Cultural Resource Survey



- side scan sonar & magnetometer
- Shipwreck Exclusion area around the shipwreck
- Ordnances

Protection of Life and Property

- Although Corps projects provide benefits such as shoreline protection, habitat protection and restoration, and the generation of tax dollars associated with recreation, the primary purpose is always the protection of life and property.

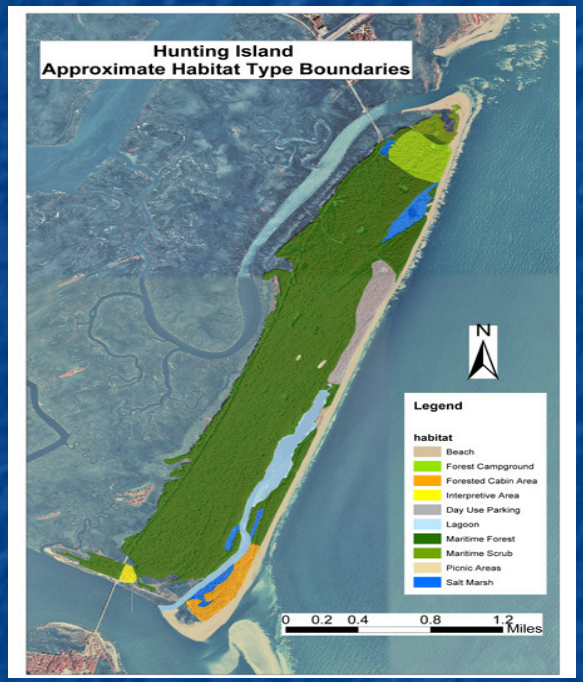
Coastal Ecosystem Restoration

Systems/Watershed Context

Budget Performance Criteria

- Scarcity
- Connectivity
- Special Species Status
- Plan Recognition
  - Hunting Island 206
  - Lower Cape May Meadows Ecosystem Restoration
  - Beach Nourishment and Bird Habitat Restoration
  - The Assateague Island Beach Restoration Project
  - Bird Island Section 206 (Buzzards Bay Mass.)

CAP: one time only
GI: 50 year project life



Feasibility Phase Results

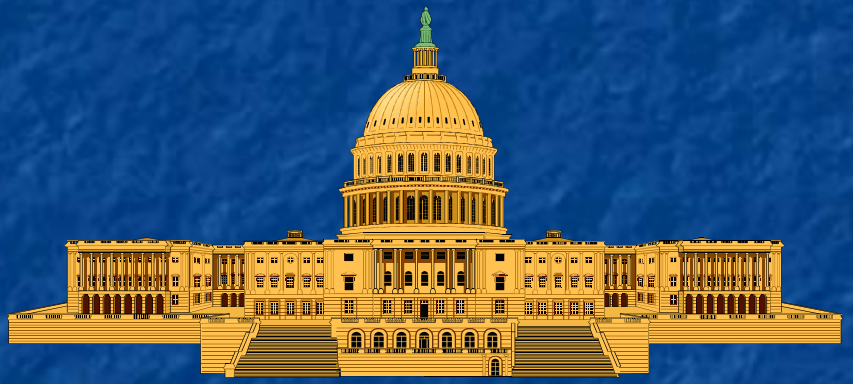
Letter of intent by State or local entity to financially participate in recommended plan implementation through a Project Partnership Agreement (PPA).

Feasibility report recommending proposed solution and congressional authorization.

Coordination of feasibility report with Federal, State and local agencies.

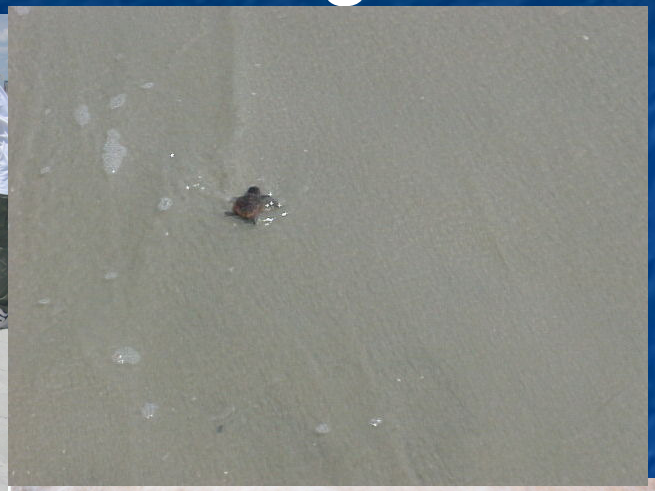
Congressional Authorization

- Chief of Engineers reports are referred to committee on public works and transportation in House and Committee on Environment and Public Works in Senate.
- Civil works projects are normally authorized by the Water Resources Development Act following committee hearings.
- Occasionally, Corps proposal is authorized by separate legislation or as part of another bill.



Construction

Monitoring for Turtle Nesting



Completed Project

Beneficial Use of Dredge Material

- **Navigation channel dredging & placement on the beach**
  - **Not "truly" beach nourishment**
  - **Beach used as dredge material disposal area**
  - **Beach compatible material, but not as stringent as true beach nourishment**
  - **Examples: Murrell's Inlet, Bird Key**
  - **Poplar Island ,**
    Chesapeake Bay

Murrell's Inlet

QUESTIONS?